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AN ALL-UNION STANDARD ON RADIO-BROADCAST RECEIVERS

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State All-Union Standard (GOST) No 5651-51, "Vacuum-Tube Radio Receivers; Classification; General Parameters," includes all types of vacuum-tube broadcast receivers, both line (ac and dc) and battery operated. The parameters specified by this GOST refer to superheterodyne receivers, but Class 3 and 4 receivers, some of which use straight amplification circuits, should have characteristics equal to those given in the GOST.

The GOST does not apply to communications receivers, automobile radios, and ultrashort-wave receivers.

The receivers are divided into four classes from the standpoint of their electrical and acoustic characteristics. Receivers of the highest quality are designated Class 1 and the simplest and cheapest ones, Class 4. There will be line and battery receivers in all classes except Class 1, the requirements of which can be met only by line receivers. Some characteristics of battery receivers vary from the norms established for line receivers. Thus, for example, the output power for battery receivers has been set considerably below that for line receivers, which is quite natural since the output power is related to the supply power used. On the other hand, the norms for frequency stability for battery receivers are more rigid since the initial heating of the tubes and parts in these receivers has less effect on their electrical characteristics than in line receivers.

With regard to the simplest (Class 4) receivers, this GOST is concerned mainly with the more important electroacoustic characteristics, those which determine the quality of the sound produced. Norms for other parameters should be established by the specifications governing the particular receiver types. Therefore, the omission in this GOST of certain parameters for Class 4 receivers should be understood in this way.

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We shall now consider the fundamental parameters determining the classification of a receiver.

The rated power, i.e., the output power (for a harmonic content not exceeding the value established by this GOST for each class of receiver) is one of the most meaningful parameters of receiver classification. The values established are: at least 4 va /Soviet sets are usually rated in volt-amperes rather than watts/ for Class 1 line receivers, 1.5 va for Class 2 ac line receivers, 0.15 va for Class 2 battery receivers, and 0.5 va for Class 3 line receivers.

The output power of Class 3 battery receivers and all Class 4 receivers has not been standardized by this GOST and should be governed by specifications.

The prescribed power supply for Class 1 line receivers is a 110-, 127-, or 220-volt ac line. The standard supply for line receivers of the other classes is ac with the above voltages, but universal ac-dc supply may be provided for. The power supply of battery receivers of all classes may be obtained from primary-cell batteries or other independent current sources.

The power consumption of line receivers is not standardized and is determined by the number of tubes used.

For battery receivers, the maximum total power which may be drawn from plate and filament batteries is: Class 2 receivers, not over 1.9 w; Class 3 receivers, not over 1.3 w; and Class 4 receivers, not over 0.8 w.

The frequency bands for Class 1 receivers are given individually for each receiver type in its specifications. For Class 2 receivers, the following bands were established: 150-415 kc (2,000-723 m) on long waves, 520-1,600 kc (575-187 m) on medium waves, and 3.95-12.1 Mc (75.6-24.8 m) on short waves. Class 1 and Class 2 receivers must have a band-spread arrangement to permit coverage of the narrow regions set aside for radio broadcasting (49, 41, 31, and 25 m).

Class 3 and Class 4 receivers should cover the long- and medium-wave bands, i.e., frequencies of 150-415 kc and 520-1,600 kc, respectively. Class 3 receivers may have a short-wave band covering 3.95-12.1 Mc (75.6-24.8 m).

In Class 4 receivers, an arrangement for reception of several pretuned stations in the long- and medium-wave bands is authorized in lieu of continuous band coverage, for the sake of simplification.

The intermediate frequency for receivers of all classes is established at 465 ± 2 kc. This will eliminate the use of different intermediate frequencies (there are at present receivers using intermediate frequencies of 456, 460, 465, and 469 kc) which has complicated correct receiver adjustment during repair and upset the standardization of receiver units. The use of an intermediate frequency of 110-115 kc is authorized only for Class 3 and Class 4 receivers; this is a simple and inexpensive means of obtaining the required sensitivity and selectivity at the expense of a slight decrease in image-frequency attenuation.

The sensitivity, measured at a modulation factor of 0.3 and 0.1 rated output power, has been standardized by the GOST with a very important limitation incorporated for the first time, namely, that the ratio of the effective signal at the receiver output side to the noise voltage (the internal noise of the receiver and the background noise) should be at least ten to one (20 db).

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For Class 1 receivers, the sensitivity, measured as indicated above, must be at least 50 μv over the entire band and at least 200 μv for pretuned stations, when the latter are used. For Class 2 receivers, the sensitivity must be at least 200 μv on long and medium waves and at least 300 μv on short waves and pretuned stations. For Class 3 line receivers, the sensitivity must be at least 300 μv on long and medium waves and 500 μv on short waves. For Class 3 battery receivers, the sensitivity must be at least 400 μv.

The sensitivity from the phono pickup jack for rated output power should be at least 0.2 v for Class 1 receivers, and at least 0.25 v for all Class 2 receivers and Class 3 line receivers. Class 3 and Class 4 battery receivers have no provisions for pickup jacks, which likewise are not compulsory for Class 4 line receivers.

The skirt selectivity, i.e., with a detuning of ± 10 kc, should be at least 46 db (200-fold attenuation) for Class 1 receivers, at least 26 db (20-fold attenuation) for Class 2 receivers, and at least 20 db (10-fold attenuation) for Class 3 receivers.

In the case of receivers with variable pass bands, the selectivity is determined for the narrow band.

The image-frequency attenuation should be at least that indicated in Table 1.

Table 1

Receiver Class	Long Waves	Medium Waves	Short Waves
1	60 db (1,000-fold)	50 db (300-fold)	25 db (20-fold)
2	36 db (60-fold)	30 db (32-fold)	12 db (4-fold)
3	26 db (20-fold)	20 db (10-fold)	Not standardized

Frequency shift of the oscillator due to internal heating (frequency stability), defined as the difference between two readings of the oscillator frequency, the first taken 5 minutes and the second 15 minutes after the receiver is turned on, should not exceed the values shown in Table 2.

Table 2

Receiver Class	For Frequencies Within the Limits		
	15 mc and Above (kc)	9-15 mc (kc)	6-9 mc (kc)
1	4	3	2
2 (line)	--	6	4
2 (battery)	--	3	2
3 (line)	--	12	8

Manual volume control should effect a change in the output voltage of no less than 50 db (300-fold) in Class 1 receivers and 40 db (100-fold) in Class 2 and Class 3 receivers.

The attenuation of an intermediate-frequency interference signal should be at least 40 db (100-fold) for Class 1 receivers, 34 db (50-fold) for Class 2 receivers, and 20 db (10-fold) for Class 3 receivers.

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Tone control is compulsory only in Class 1 and Class 2 receivers. Class 1 receivers should have provision for separate control of the lower and higher audio frequencies to permit the boosting of the lower frequencies by at least 4 db (1.6-fold) and of the higher ones by at least 6 db (2-fold), as well as the suppression of the lower and higher audio frequencies by at least 6 db. Suppression of the higher audio frequencies by at least 6 db is required in Class 2 receivers, and, in addition, it is recommended that provisions be made for boosting and suppressing the lower audio-frequencies by at least 3 db (1.41-fold).

The background noise level at the output side of line receivers, measured with the volume control set at maximum amplification, should be lower than the rated output power by no less than 46 db (200-fold) for Class 1, 37 db (70-fold) for Class 2, and 26 db (20-fold) for Class 3 receivers.

The automatic volume control should ensure a maximum voltage change at the receiver output of 12 db (4-fold) when the input voltage changes by 60 db (1,000-fold) in Class 1 receivers, a change of 8 db (2.6-fold) when the input voltage changes by 26 db (20-fold) in Class 2 receivers, and a change of 10 db (3.4-fold) when the input voltage changes by 26 db (20-fold) in Class 3 receivers.

The frequency response for the amplifier section of the receiver (fidelity curve), with respect to sound pressure, should guarantee the reproduction of an audio-frequency band having the range indicated in Table 3.

Table 3

Receiver Class	Type of Receiver: Table Model (cps)	Type of Receiver: Console (cps)
1	60 - 6,500	50 - 6,500
2	100 - 4,000	80 - 4,000
3	150 - 3,500	--
4	200 - 3,000	--

The frequency bands listed in Table 3 should be reproduced with variation not exceeding 14 db (5-fold) on all bands, except for frequencies under 250 cps, where a variation of 18 db (8-fold) is permissible.

The average sound pressure developed by receiver loud-speakers at rated output power on the frequency bands stipulated above and measured at a distance of one meter from the receiver (for battery receivers it is further specified that they must not use more power than the norm prescribes) should be at least 20 bars for Class 1 sets, 10 bars for Class 2 line receivers, 3 bars for Class 2 and Class 3 battery receivers, 4.5 bars for Class 3 line receivers, and 3.5 bars for Class 4 line receivers. For Class 4 battery receivers under the same conditions, a sound pressure norm of 2.5 bars has been established, which, however, can drop to 1.5 bars if the power drawn is reduced correspondingly.

The harmonic content is standardized for the entire amplifying section of the receiver and is measured by sound pressure at rated output power. This GOST establishes permissible harmonic contents at various frequencies, as shown in Table 4, in contrast to former systems which evaluated nonlinear distortion only at one frequency, namely, 400 cps.

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Table 4

Receiver Class	Harmonic Content in Percent at Frequencies			
	Up to 100 cps	100-200 cps	200-400 cps	Over 400 cps
1	12	7	7	5
2	--	10	7	7
3	--	--	12	10

Harmonic contents of up to 15% are permissible for the lowest audio frequencies of the response band established for Class 1 and 2 receivers.

All line receivers are required to have a pilot light to indicate that the receiver is turned on, while battery receivers must have a mechanical device for this purpose. The GOST authorizes electrical indicators for battery receivers (for example, a neon lamp) but does not make them compulsory. Tuning indicators are also required in all Class 1 and 2 line receivers.

A variable pass band is compulsory only in Class 1 receivers; it is not required in Class 2 receivers. A provision for connecting an external loud-speaker to the receiver is required only in Class 1 and Class 2 receivers, while a provision for connecting the receiver loud-speaker to the wired radio network is obligatory for all battery receivers. This requirement is not compulsory for line receivers. The recommended number of vacuum tubes is not more than seven for Class 2 receivers, five for Class 3 receivers, and four for Class 4 receivers. The Gost does not regulate the number of tubes for Class 1 receivers.

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